December, 1988

Final Report



A Conference on "Diagnostic Monitoring of Skill and Knowledge Acquisition"

Norman Frederiksen

Educational Testing Service



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chapters, and 4 discussants have so far contributed commentaries to sets of chapters (a fifth commentary will probably be added). A manuscript containing an introduction, the 15 chapters, and four commentaries has been sent to the publisher for publication under the title "Diagnostic Monitoring of Skill and Knowledge Acquisition." The publication date is expected to be sometime in the fall of 1989.

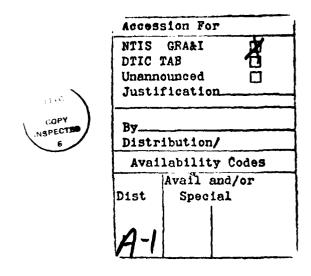
### Final Report

Grant No. N00014-85-G-0217

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The purpose of this project was to encourage cognitive scientists to consider the implications of their research for assessment as well as for instruction. Conventional methods of assessment are not adequate for two reasons: (a) since the score on a conventional test is based on the number of correct answers to a set of items that vary widely in difficulty and in content, it is not possible to obtain such qualitative information as a student's problem-solving procedures or the nature of his/her mental model of a domain; and (b) the items of conventional tests tend to emphasize factual and algorithmic knowledge rather than understanding.

It was proposed that a conference be held at which leading cognitive scientists would address the question of how their work could be adapted to assessing various aspects of performance during learning, such as level of automatization of basic procedures, incomplete or erroneous knowledge structures, and inadequate regulatory control strategies. The conference was thus intended to call attention to the need for diagnostic monitoring of skill and knowledge acquisition during the instructional process and to provide examples of assessment methods that grow out of cognitive research.

When the project was funded in the fall of 1985, Michael Shafto was designated Scientific Officer, and arrangements were made for Robert Glaser and Alan Lesgold to serve as advisors to the project. Our first task was to decide on who should be invited to participate in the conference. After a meeting at LRDC and after allowing several weeks for consideration, a selection was made of those who should be invited to present papers or serve as discussants. Almost all of those invited agreed to participate.

Since the research of most of the presenters was concerned with learning rather than assessment, we felt that a special effort was needed to orient them toward applications of their work toward diagnosis of sources of error and misconceptions, and thus to develop a shared point of view with regard to the purpose of the conference. Therefore a planning meeting was held at LRDC in November 1985 at which the theme of the conference was discussed and each participant was given an opportunity to reflect and report on the implications of his or her research for assessment. The goal was to achieve a well-integrated set of presentations and eventually chapters for publication in book form.

The conference was held at the Henry Chauncey Conference Center at ETS on July 17, 18, and 19, 1986. A copy of the program is attached. The conference was attended by approximately 65 people, including not only cognitive scientists but also educators, educational researchers, and psychometricians.

At the time of the conference, a contract for publication of the proceedings by Lawrence Erlbaum Associates was agreed to. The four editors are N. Frederiksen, R. Glaser, A. Lesgold, and M. G. Shafto. The MS was sent to the publisher in late November, 1988. Copies of the title page and the table of contents are appended. The MS is complete except for one commentary, which may yet arrive in time to be included in the volume. If all of the corrected proofs are returned to the publisher promptly, the publication date should be in the late fall of 1989.

### PROGRAM

# Conference on Diagnostic Monitoring of Skill and Knowledge Acquisition

## Thursday, July 17

0.00	Cross April	Opening Remarks		
9:00	Gregory Anrig	•		
	C. Victor	r Bunderson, Chairman		
9:10	John R. Anderson	Analysis of Student Performance with the LISP Tutor		
9:50		Discussion		
10:00	John Frederiksen and Barbara White	Intelligent Tutors as Intelligent Testers		
10:40		Discussion		
10:50		BREAK		
11:05	David Kieras	The Role of Cognitive Simulation Models in Advanced Training and Assessment Technology		
11:45	Discussion			
11:55	Allan Collins (discussant)			
12:20	Ge	neral discussion		
12:30		LUNCH		
William C. Ward Chairman				
1:30	James Reggia	The Role of Diagnostic Reasoning Models in Assessment and Adaptive Instruction		
2:10		Discussion		
2:20	Pat Langley, Stellan Ohlsson, & James Wogulis	Rules and Principles in Automated Cognitive Diagnosis		
3:00		Discussion		
3:10		BREAK		
3:25	Stellan Ohlsson	Intensive vs. Extensive Cognitive Diagnosis: A Case Study and Its Implications		
4:05		Discussion		
4:15	James D. Hollan (discussant)			
4:40	Gen	eral Discussion		
5:00		ADJOURN		

# Friday, July 18

# Roy O. Freedle, Chairman

9:00 Harry S. Pople and Cynthia S. Gadd  Bridence from Internal Medicine Teaching Rounds of the Multiple Roles of Diagnosis in the Transmission and Testing of Medical Expertise  9:40 Discussion  9:50 Ann Brown and Joseph C. Campione  Discussion  LUNCH  Henry I. Braun, Chairman  Discussion  Discussion		<del>-</del>		
9:50 Ann Brown and Joseph C. Campione Guided Learning and Transfer: Implications for Assessment  10:30 Discussion  10:40 BREAK  11:00 Carl Frederiksen Evaluating Prior Knowledge and Its Use in Comprehension, Knowledge Integration, Production, and Problem Solving  11:40 Discussion  11:50 George A. Miller (discussant)  12:15 General discussion  12:35 LUNCH Henry I. Braun, Chairman  1:30 Sandra P. Marshall Selecting Good Diagnostic Items  2:10 Discussion  2:20 Susan Embretson Psychometric Methods for Diagnosing Processing at Different Performance Levels  3:00 Discussion  3:10 BREAK  3:30 Kikumi Tatsuoka Toward an Integration of Item-Response Theory and Cognitive Error Diagnoses  4:10 Discussion  4:20 Robert Linn (discussant)  4:45 General discussion	9:00		Rounds of the Multiple Roles of Diagnosis in the Transmission and	
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5:00 ADJOURN	4:45	(	General discussion	
	5:00		ADJOURN	

# Saturday, July 19

# Walter Emmerich, Chairman

9:00	Robert S. Siegler	Diagnostic Monitoring of Strategy Choice Procedures		
9:40		Discussion		
9:50	Mary S. Riley	Diagnosing Levels of Competence in Knowledge-Rich Domains		
10:30		Discussion		
10:40		BREAK		
11:00	Sherrie Gott (discussant)			
11:25	G	eneral discussion		
11:45	•	LUNCH		
Garlie A. Forehand, Chairman				
12:45	Walter Schneider and Wesley Regian	Assessment Procedures for Predicting and Optimizing Skill Acquisition in Extended Training		
1:25		Discussion		
1:35	Alan Lesgold	Cognitive Task Analysis Approaches to Testing		
2:15		Discussion		
2:25		BREAK		
2:45	Judith Orasanu (discussant)			
3:10	Ge	neral discussion		
3:30	Robert Glaser	The Final Word		
4:00		ADJOURN		

### DIAGNOSTIC MONITORING OF SKILL AND KNOWLEDGE ACQUISITION

### Edited by

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